

Notice No. 9

Rules and Regulations for the Classification of Offshore Units, July 2014

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Issue date: June 2015

Amendments to	Effective date
Part 8, Chapter 1, Sections 1, 2 & 3	1 July 2015
Part 8, Chapter 2, Sections 1, 2, 4, 6 & 7	1 July 2015
Part 8, Chapter 3, Section 1	1 July 2015
Part 8, Chapter 4, Sections 1, 2 & 3	1 July & Corrigendum

Part 8, Chapter 1

General Requirements for Corrosion Control

Effective date 1 July 2015

■ Section 1 Corrosion protection

1.3 External zone protection

1.3.2 The structural steelwork in the boot topping and splash zones is normally to be protected by suitable coatings but consideration may be given to the following:

- (a) Extra steel in excess of the Rule requirements.
- (b) Metallic cladding resistant to the environment where appropriate.

1.3.4 The structural steelwork in the submerged zone is to be protected by an approved means of cathodic protection using sacrificial anodes or an impressed current system, except where noted otherwise in Table 1.1.1. High resistance coatings may be required or used in conjunction with a cathodic protection system but they will not be accepted in lieu except where noted in Table 1.1.1. An alternative means of protection such as increased scantlings may be considered in special areas. Where In-Water Survey notation OIWS is to be assigned corrosion, protection in submerged zone shall be provided by high resistance coatings supplemented by cathodic protection; this is considered to be the optimal means of protection for all submerged components.

1.4 Internal zones

1.4.4 In deep draught caisson units and other units with combined oil storage and ballast tanks which remain full during the service life of the unit, special consideration will be given to the requirement for internal corrosion protection of the tanks. In general, the minimum Rule scantlings of tanks as required by Pt 4, Ch 6,7 are to be suitably increased based on a study of likely degradation rates and service life of unit.

1.5 Bimetallic connections

1.5.1 Where bimetallic connections are made in the structure, suitable measures are to be incorporated to preclude galvanic corrosion. Details are to be submitted for approval on the structural plans required in Pt 4, Ch 1,4. The combination of painting the less noble material and leaving the more noble material uncoated for an immersed bimetallic couple is not permitted. In submerged zones cathodic protection is considered to be a suitable mitigation measure as it will eliminate the potential differences across the bimetallic connection.

1.6 Chain cables and wire ropes

1.6.1 Chain cables and wire ropes for positional mooring systems are to be protected from corrosion and the requirements of Pt 3, Ch 10 are to be complied with. Current drain from the mooring system is to be considered in cathodic protection design as required in Ch 4,1.

■ Section 2 Riser systems

2.1 General

2.1.2 The splash and boot topping zones of risers are to be specially considered. A corrosion allowance will be required in addition to any coatings. The corrosion allowance should be defined based on corrosion rate and service life in the relevant location and a default 6mm applied unless demonstrated to be onerous based on environmental conditions, materials and service life, deviations shall be agreed with LR. Risers in J-tubes, etc., will require separate assessment of protection.

2.1.3 ~~Where the cathodic protection system is designed to compensate for loss of protective coating, the system should be based on an initial loss of coating of between 5 and 10 per cent. Due allowance should be made for further breakdown during the service.~~

Part 8, Chapter 1

2.2 External coatings

~~2.2.3 Preparation of the riser surface before coating is to comply with the approved specification relating to that material, see Ch 4.3.5~~

2.4 Cathodic protection systems

2.4.1 Cathodic protection systems are to comply with the requirements of Chapter 2.

2.4.2 Visual inspection surveys with measurements of potential are to be taken periodically and any deficiencies in terms of potential readings above the protection potential of $-0.8V \text{ Ag/AgCl}$ or detached anodes corrected by the addition of extra sacrificial anodes or adjustment of ICCP system controls.

2.4.3 Measurements For ICCP systems, measurements are to be taken to confirm that there is no over-protection. Over-protection is considered to be readings more negative than $-1.2V \text{ Ag/AgCl}$.

2.4.4 Stray currents, current drain and including that from the mooring system and interference from ships, other vessels or installations in the vicinity are to be evaluated and appropriate measures taken.

■ Section 3 Plans and information

3.2 Cathodic protection systems

3.2.1 The following plans and information are to be submitted:

- (a) A surface area breakdown for all areas to be protected including secondary steelwork and details of appurtenances.
- (b) The resistivity of the sea water and sediments.
- (c) All current densities used for design purposes.
- (d) The type and location of any reference electrodes and their methods of attachment.
- (e) Full details of any coatings used and the areas to which they are to be applied.
- (f) Details of any electrical bonding.
- (g) Details of current drain.
- (h) Stray current considerations.

3.5 Coating systems

3.5.1 The following plans and information are to be submitted:

- (a) Evidence that any primers used will have no deleterious effect on subsequent welding or on subsequent coatings.
- (b) Details of the painting specification with regard to:
 - (i) The generic type of the coating and conformation of its suitability for the intended environment;
 - (ii) The methods to be used to prepare the surface before the coating is applied and the standard to be achieved. Reference should be made to established International or National Standards;
 - (iii) The method of application of the coating; and
 - (iv) The number of coats to be applied and the total dry film thickness.
- (c) Details of the areas to be coated.
- (d) Inspection and Testing Plan

Part 8, Chapter 2

Cathodic Protection Systems

Effective date 01 July 2015

■ Section 1 General requirements

1.1 Objective

1.1.1 The cathodic protection system for the external submerged zone is to be designed for a period commensurate with the design life service life of the structure or the dry-docking interval and it should be capable of polarising the steelwork to a sufficient level in order to minimise corrosion at any point in the service life.

1.3 Criteria for cathodic protection

1.3.1 Cathodic protection systems are to comply with BS EN 13173 – *Cathodic protection for steel offshore floating structures* or BS EN 12495 – *Cathodic protection for fixed steel offshore structures* unless local legislation requirements dictate otherwise; replacement standards shall be listed and submitted to LR for approval.

■ Section 2 Sacrificial anodes

2.2 Anode Materials

2.2.1 The anode materials are to be approved alloys of zinc or aluminium. with A closed-circuit potential more negative than of at least –1,00 volt (Ag/AgCl reference electrode) for Zinc anodes and -1,05 volt (Ag/AgCl reference electrode) for Aluminium anodes shall be achieved in seawater at ambient temperature up to 30°C. Magnesium-based anodes may be used for short-term temporary protection of materials not susceptible to hydrogen embrittlement, see also 2.13.12. Anode materials and anode designs specified in BS EN 13173 or BS EN 12495 are also permitted.

2.4 Chemical composition

2.4.1 The chemical composition of the heat is to be determined prior to casting. No alloying additions are to be made following chemical analysis without further analysis. For heats greater than 1 tonne, a further sample is to be analysed at the end of the cast. All anodes cast are to comply with the approved specification. Typical chemical compositions for Al-Zn-In type and zinc type anodes which are known to perform well in many conditions are provided below. Other compositions may be used if testing demonstrates that the required electrochemical properties can be achieved. Any testing shall be submitted to LR for approval.

Table 2.1.1 Aluminium anode composition

Element	Mass Fraction (w)	
	Min. %	Max. %
Zn	2,5	5,75
In	0,016	0,040
Fe	-	0,09
Si	-	0,12
Cu	-	0,003
Cd	-	0,002
Others	-	0,02 (each)
Al	Remainder	

Table 2.1.2 Zinc anode composition

Element	Mass Fraction (w)	
	Min. %	Max. %
Cu	-	0,005
Al	0,10	0,50
Fe	-	0,005
Cd	0,025	0,07
Pb	-	0,006
Zn	Remainder	

Part 8, Chapter 2

■ Section 4 Fixed potential monitoring systems

4.1 General

4.1.1 A permanent monitoring system is to be installed on structures protected by an impressed current cathodic protection system, and, although not essential, such a monitoring system is recommended for use in conjunction with sacrificial anodes. Monitoring schemes shall comply with BS EN 13509 – *Cathodic protection measurement techniques*.

4.1.2 Zinc or Ag/AgCl reference electrodes should be used. Reference electrode materials and design specified in the above standard are also permitted.

4.1.3 Variations between electrodes of ± 30 mV have been reported for zinc/sea-water reference electrodes and ± 5 mV for silver/silver chloride/sea-water electrodes but unless a high degree of stability is required, either electrode may be used for comparison purposes. The zinc/sea-water electrode may be taken as approximately 1,03 V more positive than the silver/silver chloride/sea-water electrode.

~~4.1.3~~ 4.1.4 The location and attachment of the reference electrodes are to take account of the stresses in the members concerned and they should not be attached in highly stressed areas or in way of butts, seams, nodes or any stress raisers.

~~4.1.4~~ 4.1.5 The location of the reference electrodes should be such as to enable the performance of the cathodic protection system to be adequately monitored.

~~4.1.5~~ 4.1.6 The reference electrodes may be connected to the top side display and control equipment by suitable cabling or by any other agreed means.

~~4.1.6~~ 4.1.7 Provision is to be made for the regular recording at an agreed interval of the potential of the steelwork and log sheets are to be made available for inspection when required by LR Surveyors.

■ Section 6 Potential surveys

6.1 General

6.1.2 Should the results of any potential survey measured with respect to a Ag/AgCl reference cell indicate values more positive than $-0,8$ volt for aerobic conditions or $-0,9$ volt for anaerobic conditions then remedial action such as retrofit of sacrificial anode or adjustment and maintenance of ICCP system is to be carried out at the earliest opportunity.

■ Section 7 Retrofits

7.1 General

7.1.1 Where it is proposed to fit additional anodes or replace existing ones, full details including information listed below are to be submitted for consideration:

- (a) Existing CP system performance study
- (b) Cause of any premature failure of the system
- (c) Design calculations and drawings
- (d) CP potential modelling
- (e) Deviations from class requirements based on in service performance on station

Part 8, Chapter 3

Coating and Paint Systems

Effective date 1 July 2015

■ Section 1 General requirements

1.1 General

1.1.4 Paints or other similar coatings containing >10% aluminium by weight in dry film should not be used in positions where flammable vapours may accumulate, unless it has been shown by appropriate tests that the paint to be used does not increase the incendive sparking hazard.

Part 8, Chapter 4

Guidance Notes on Design of Cathodic Protection Systems and Coatings

Effective date 1 July 2015 and Corrigendum

■ Section 1 External steel protection

1.1 Current Density

1.1.2 Design current density values are given in Table 4.1.1 for guidance purposes, but the values to be used should be based on the environmental conditions prevailing at the site. It should be noted that these values may be appreciably different from values actually measured on steelwork in the vicinity of the site.

Table 4.1.1 Current density values for design purposes

Location	Current density mA/m ²
Cook inlet	400
North Sea (Northern) Above 62°N 55°N to 62°N	130
US (West Coast)	100
North Sea (Southern) Below 55°N	90
Africa	90
Brazil	90
China	90
India	90
Mediterranean	90
Australia (Western)	80
Gulf	80
Gulf of Mexico	80
Mud — Most locations	20
Drainage per well	5A

Part 8, Chapter 4

NOTES

1. The current density values are intended for guidance purposes in the design of sacrificial anode systems using the methods as outlined in this Chapter.

However, other values may be accepted provided that there is adequate justification.

2. For impressed current cathodic protection systems, current densities higher than the values given in the Table may be necessary but this will depend on the type and location of the anodes.

Location	Current density mA/m ²		
	Initial	Mean	Final
Cook inlet	400	400	400
North Sea (Northern) Above 62°N 55°N to 62°N	220	100	130
	180	90	120
North Sea (Southern) Below 55°N	150	80	100
Arabian Gulf, Africa, Brazil, China, India	130	70	90
Mediterranean, Australia (Western), Gulf of Mexico, Adriatic Sea, US West Coast	110	60	80
Mud – Most locations	25	20	20
Drainage per well	5A		

NOTES

1. The current density values are intended for guidance purposes in the design of sacrificial anode systems using the methods as outlined in this Chapter. However, other values may be accepted provided that there is adequate justification.

2. For impressed current cathodic protection systems, current densities higher than the values given in the Table may be necessary but this will depend on the type, location and quantity of the anodes.

1.1.3 In order to minimise pitting, the cathodic protection system must be capable of rapidly polarising the steelwork and it is recommended that the initial current density should be appreciably higher than the values given in Table 4.1.1 the cathodic protection design must demonstrate that the system is capable of initially polarising the structure rapidly In order to minimise pitting.

1.1.4 Although a lower current density may be capable of maintaining polarisation, the cathodic protection system must be capable of re-polarising the steelwork rapidly after storms, even when the anodes are well wasted, this should be demonstrated in design calculations.

1.1.7 For an epoxy or coal tar epoxy coating applied to give a dry film thickness of 250 to 500 microns, an initial coating breakdown factor of one to two per cent for the submerged zone and an annual degradation rate of one to one and a half three per cent per year should be used, in line with ISO 13173, unless agreed otherwise with Class. Coating breakdown factors for high build coatings, applied to give a dry film thickness of 1000 to 3000 microns should be lower and agreed with Class.

1.1.8 For other coating systems an initial breakdown factor of minimum 5% should be used and added to any area that is visibly damaged. Due allowance should be made for further breakdown during the service life given in 1.1.7.

1.1.9 Current drain due to risers, mooring lines and other electrically connected structures shall be considered in the current requirement calculations and be fully documented.

1.1.10 Current density of propeller and rudder components and surrounding areas are likely to require a significantly higher current density to polarise and maintain protection through life. Design of cathodic protection systems for propeller and rudder components should be based on a minimum current density of 400mA/m² and 200mA/m² respectively.

Part 8, Chapter 4

1.2 Sacrificial anode systems

1.2.5 The resistance of an anode, R , with small crosssection in relation to its length ($4r \leq L$) and with a stand-off distance from the bottom of the anode surface to the structure of not less than 300 mm, is given by:

$$(a) \quad R = \frac{\rho}{2\pi l_a} \left(\ln \frac{4l_a}{r} - 1 \right)$$

where

ρ = resistivity of sea-water, in ohm.cm

l_a = length of anode, in cm

r = equivalent radius of anode, in cm

\ln = \log_e

$$r = \sqrt{\frac{a}{\pi}}$$

a = cross-sectional area of the anode, in cm^2

(b) When bracelet anodes are used, the resistance may be determined using:

$$R = \frac{0,315\rho}{\sqrt{A_e}}$$

where

A_e = the exposed surface area of the anode, in cm^2 .

1.3 Location of anodes

1.3.1 Having determined the number and size of the anodes to comply with the recommended nominal current density and the required life, the anodes should be distributed over the steel surfaces according to the required level of protection on the steelwork but with some emphasis on the area adjacent to joints, etc. CP potential modelling can be considered to aid distribution to ensure full coverage. The anodes associated with the structure likely to become buried, such as footings, etc., should be positioned on the steelwork immediately above the mudline.

■ Section 2 Protection of tanks

2.3 Anode distribution

2.3.1 Once the number and size of anodes have been determined, they are to be distributed as follows:

- (a) **Ballast-only tanks:** evenly over all the steelwork with some consideration given to the lower sections based on usage pattern and ballasting levels.
- (b) **Crude oil/ballast tanks:** evenly but with some emphasis on horizontal surfaces in proportion to the area of these surfaces.

2.4 Reference electrodes

~~2.4.1 Variations between electrodes of ± 30 mV have been reported for zinc/sea-water reference electrodes and ± 5 mV for silver/silver chloride/sea-water electrodes but unless a high degree of stability is required, either electrode may be used for comparison purposes. The zinc/sea-water electrode may be taken as approximately 1,03 V more positive than the silver/silver chloride/sea-water electrode.~~

■ Section 3 Surface preparation, application and maintenance of coatings

3.1 Application

The following paragraph shows a corrigendum amend.

3.1.6 Coating manufacturers should have products with documented service performance records. Coatings recognised by Lloyd's Register (LR) are considered as satisfying this requirement, see list of LR approved PSPC compliant coatings on ~~CD-Live~~ **Class Direct**. Where it is proposed to use coatings without satisfactory performance records, coating selection should be supported by appropriate laboratory test data carried out in accordance with recognised Standards (e.g., ISO 20340) in order to verify their suitability for the intended service condition.

The following amends have an effective date of 1 July 2015.

3.5 Surface Preparation

Part 8, Chapter 4

3.5.3 ~~The surface preparation for coatings should be in accordance with the coating manufacturer's specification.~~ All oil and grease is to be removed from the surface with suitable solvents prior to blast cleaning.

3.5.6 The compressed air supply used for blasting is to be free of water and oil and adequate separators and traps are to be provided. Prior to using compressed air, the quality of the air downstream of the separator should be tested by blowing the air on to a clean white blotter or cloth for two minutes to check for any contamination, oil or moisture. This test should be performed at the beginning and end of each shift and at not less than four-hour intervals. ~~If two consecutive tests show no contamination the interval can be extended to once per shift, if subsequent tests show contamination then the four-hour interval is to be reinstated.~~ The test also should be made after any interruption of the air compressor operation. The air should be used only if the test indicates no visible contamination, oil or moisture. If contaminants are evident, the equipment deficiencies should be corrected and the air stream should be retested.

3.5.11 The amplitude of blast profile from trough to adjacent peak depends upon the type of coating to be applied. The amplitude should be not more than 50 μm for coatings of the zinc silicate type and not more than 75 μm of the high build coatings, ~~unless otherwise specified by the manufacturer.~~ A procedure to measure the surface profile of abrasive blast cleaned steel on site is given in NACE RP 0287.87. The technique utilises a tape that replicates the surface profile and the thickness of the tape is then measured using a micrometer.

3.9 Inspection and repair

3.9.11 When dry film thicknesses are less than those specified, additional coats are to be applied as necessary to achieve specified thickness. For inorganic zinc silicate, areas of low film thickness should not be repaired by additional coats. In this case the coating is to be removed and the area re-coated to the specified thickness ~~or paint manufacturer's recommendation.~~

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